1704/102
MATHEMATICS I AND
PHYSICAL SCIENCE
June/July 2018
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

CRAFT CERTIFICATE IN BUILDING TECHNOLOGY MODULE I

MATHEMATICS I AND PHYSICAL SCIENCE

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
*   *Answer booklet;*
*   *Mathematical tables/Scientific calculator.*
This paper consists of EIGHT questions in TWO sections; A and B.
Answer any FIVE questions choosing at least TWO questions from each section.
All questions carry equal marks.
Maximum marks for each part of a question are indicated.
Candidates should answer the questions in English.

This paper consists of 6 printed pages.

Candidates should check the question paper to ascertain that
all the pages are printed as indicated and that no questions are missing.

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SECTION A: MATHEMATICS I

Answer at least TWO questions from this section.

1. (a) Simplify $\dfrac{\frac{1}{5}\ of\ \left(\frac{1}{4}+\frac{1}{3}\times1\frac{1}{7}\right)}{\frac{17}{25}-\frac{2}{3}\ of\ \frac{31}{60}\div\frac{1}{15}}$. (4 marks)

   (b) Amagon Constituency received Ksh 48,000,000 for the Constituency Development Fund. Twenty million was spent on development of schools and health centres, five million was spent on constituency development while seven million was spent on youth enterprises. The reminder was issued as bursaries to one thousand needy high school students, who received Ksh 6,000 each. The remaining amount was issued to 250 university students in the constituency. If the university students received equal amount, how much did each get? Give your answer in words. (6 marks)

   (c) Evaluate:

   $103.026 + 576.95117 + 79.022863.$ (2 marks)

   (d) Find the value of m that satisfies the equation:

   $4^{m+1} - 2^m - 2^{m+3} + 2 = 0$ (8 marks)

2. (a) Make x the subject of the formula $\dfrac{p}{q} = \dfrac{mx-2}{nx+4}$. (3 marks)

   (b) Solve for n

   $75\,n^2 + 20\,n - 9 = 0$ (3 marks)

   (c) The law connecting x and y is given by $y = nx + \dfrac{m}{x^2}$. If $x = 2$, when $y = 4$ and $x = 4$ when $y = 6.25$, find the values of m and n. (4 marks)

   (d) The following set of data refers to the amount of money in £ s taken by a news vendor for 6 days. Determine the mean and median values of the set:

   (27.90, 34.70, 54.40, 18.92, 47.60, 39.68) (8 marks)

   (e) In a triangle ABC, $\angle B = 90°$, AB = 6 cm and BC = 3 cm. Find the length of AC. (2 marks)

3. (a) Osundwa bought five exercise books and three geometrical sets for Sh 725. If he had bought four similar exercise books and five geometrical sets, he would have paid Sh 375 more. How much would be pay for two exercise books and six geometrical sets?

(6 marks)

(b) Metal cube of side 4.4 cm was melted and the molten material used to make a sphere. Find to 3 significant figures the radius of the sphere $\left(\pi=\frac{22}{7}\right)$.

(4 marks)

(c) Find the sum of the first 12 terms of the series 5, 9, 13, 17, ...

(4 marks)

(d) The angle of depression of a point A on the ground from top of a post is 18° and that of another point B on the same line as A nearer to the foot of the post is 25°. If A and B are 70 m apart,

(i) draw a sketch to represent positions of A and B. (2 marks)

(ii) calculate the distance of point A from the post. (4 marks)

4. (a) Evaluate $2\cos 60° + 5\sin 30°$ without using a calculator. (4 marks)

(b) The third and fifth terms of an arithmetic progression are 10 and −10 respectively. Determine the 1st term and the common difference. (4 marks)

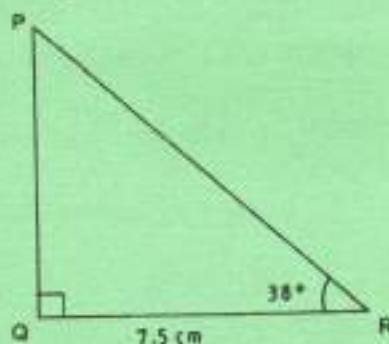(c) Find the length of PQ and PR in a triangle PQR shown in **figure 1** below: (2 marks)

Fig. 1

(d) Solve for x given that:

$$\frac{x-3}{5} = 4 - \frac{x-2}{2}.$$

(4 marks)

(e) The table below represents the speed Vkm/hr of a bus at different time t/hr.

Time (t) in hr	0.5	1	1.5	2	2.5
Speed (v) in km/hr	47	56	60	65	73

(i) Plot the value of speed (v) against time (t) on a graph paper. (4 marks)

(ii) Use your graph to determine the speed of the bus at t = 1.3 hr and at t = 2.1 hr. (2 marks)

SECTION B: PHYSICAL SCIENCE

*Answer at least **TWO** questions from this section.*

5. (a) Give the chemical formula for:

   (i) Hydrochloric acid;
   (ii) Ethanoic acid.

   and state which of the two acids is stronger. (4 marks)

   (b) (i) Explain the existence of isotopes. (1 mark)

   (ii) You are provided with copper II oxide, water, diluted nitric acid and sodium carbonate. Describe how you can prepare crystals of copper carbonate. Use chemical equation where possible.

   (iii) Element X has two isotopes $^{35}_{17}X$ and $^{36}_{17}X$ with relative abundance of 21% and 79% respectively. Calculate its relative atomic mass. (3 marks)

   (c) (i) State **two** uses of acids. (2 marks)

   (ii) Write a balanced chemical equation for the reaction between magnesium and steam. (2 marks)

   (d) (i) State differences between a mixture and a compound. (2 marks)

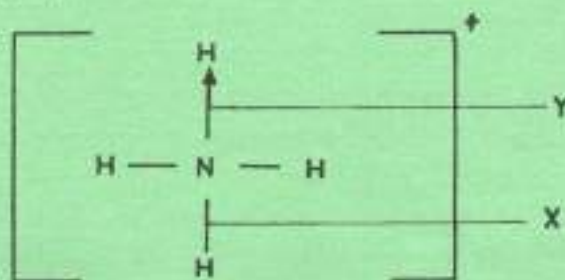   (ii) Study the structure of Ammonium ion in **figure 2** and answer the questions below.

Fig. 2

Name the type of bond labelled:

(I) Y;
(II) X. (6 marks)

6. (a) You are provided with the following:

    (i)   a test tube;
    (ii)   lead shot;
    (iii) water in a beaker;
    (iv)   a liquid of a density different from that of water.

    Describe how you would construct and calibrate simple hydrometer and use it to measure the density of the liquid.   (8 marks)

    (b) A block of wood of mass 5000 kg and density 600 kg/m³ floats on water. Determine the minimum weight that can be placed on the block to make it sink.
    (Density of water is 1000 kg/m³)   (6 marks)

    (c) Define the following terms:

    (i)   density;
    (ii)   pressure;
    (iii) power;
    (iv)   moment.   (4 marks)

    (d) State the S.I units of the following:

    (i)   force;
    (ii)   mass.   (2 marks)

7. (a) State the law of moments.   (1 mark)

    (b) A solid body rests with its flat surface on horizontal ground. State two factors that determine the stability of the body.   (2 marks)

    (c) **Figure 3** shows a uniform bar of weight 3N and length 1.0 m pivoted at a point and in equilibrium under the action of the forces shown
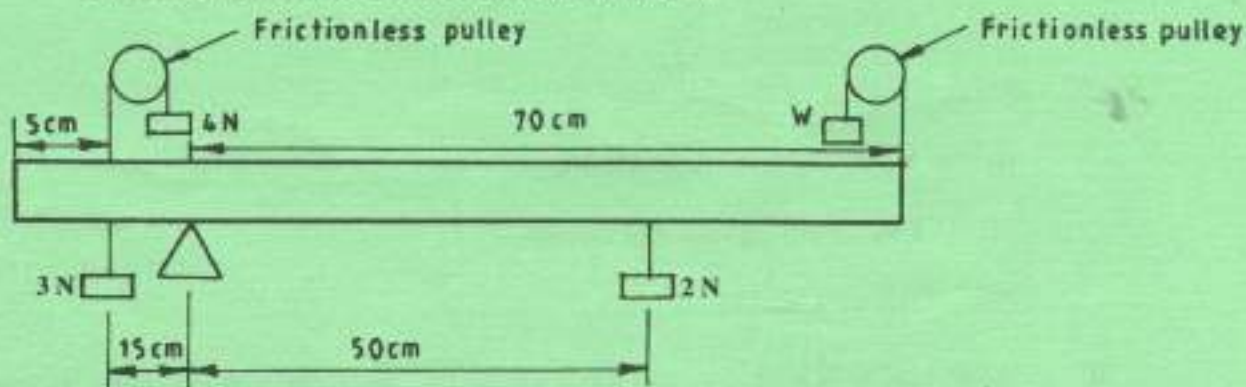

Fig. 3

    (i)   Write the expression for the clockwise moments and the anti-clockwise moments.   (4 marks)

    (ii)   Determine the anti-clockwise moments.   (2 marks)

    (iii)   Determine the value of weight W.   (2 marks)

(d)   A 20 m uniform plant AB of mas 20 kg is put on a wedge such that it does not balance horizontally. Three pupils of mass 50 kg, 35 kg and 30 kg sat on the plant at a distance of 3 m, 7 m and 18.5 m respectively from A. How far must the wedge be placed from A for the arrangement to balance horizontally.   (5 marks)

(e)   When a body of mass 0.25 kg is acted on by a force, its velocity changes from 5.0 ms^{-1} to 7.5 ms^{-1}. Determine the work done by the force.   (4 marks)

8.   (a)   The diagram below shows two trolleys X and Y, held together at rest against a compressed spring. When they are released at the same time, X moves to the left at 8 ms^{-1}.
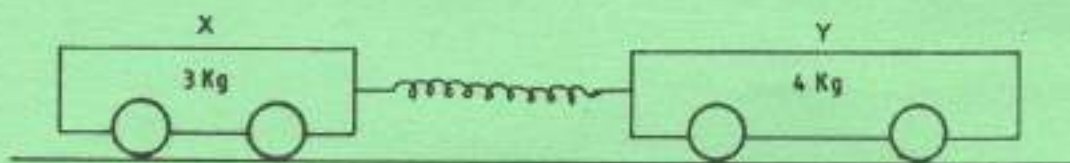

Fig. 4

Calculate the potential energy which was stored in the compressed spring.   (6 marks)

(b)   The height of a mercury barometer at a place is found to be 58 cm. What is the atmospheric pressure at the place. (Density of mercury is $1.36 \times 10^4 \text{ kgm}^{-3}$).   (4 marks)

(c)   Define the following terms:

    (i)   velocity;
    (ii)   speed;
    (iii)   distance;
    (iv)   displacement.   (4 marks)

(d)   State:

    (i)   Newton's first law of motion.   (1 mark)

    (ii)   Law of conservation of energy.   (1 mark)

    (iii)   Hooke's law.   (1 mark)

(e)   A force of 50 N is used to pull a box along the ground through a distance of 7 m and the box moves in the same direction as the force. Determine the work done by force.   (3 marks)

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